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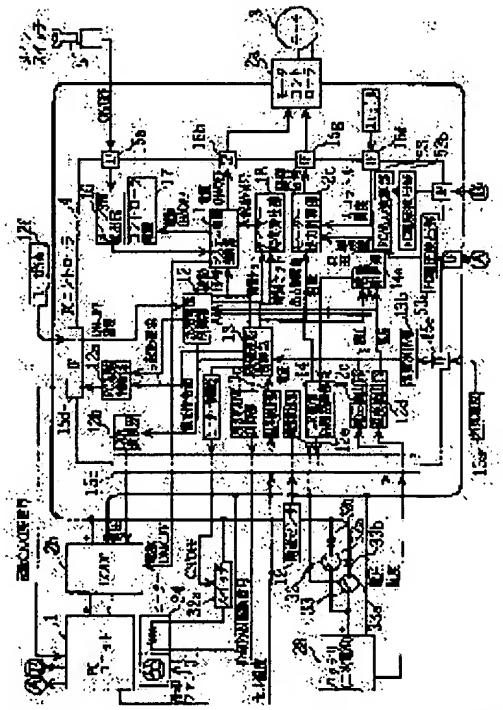
(54) CHARGING DEVICE FOR MOTOR-DRIVEN VEHICLE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a charging device for a motor-driven vehicle capable of charging a secondary battery by shorted capacity while parking and the like by constituting a function of automatically charging the secondary battery even when a main switch is in an 'off' state.
SOLUTION: In a charging device for an motor-driven vehicle 20 provided with a generator 1 and the secondary battery which is charged by the generator 1 while traveling and which supplies power to a driving motor 3, the residual capacity of the secondary battery is detected periodically in the 'off' state of the main switch 5. When the detected residual capacity is equal to or less than a given value, the generator 1 is started to charge the secondary battery 28.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] Charging equipment of the electric car which detects the remaining capacity of the above-mentioned rechargeable battery periodically where a main switch is turned off in the charging equipment of the electric car carrying the rechargeable battery used as the power source of a drive motor while charging with this power plant during a power plant and transit, and is characterized by starting the above-mentioned power plant and charging the above-mentioned rechargeable battery when the this detected remaining capacity is below a predetermined value.
[Claim 2] Charging equipment of the electric car characterized by carrying the fuel cell system used as the power source of the above-mentioned drive motor during transit while functioning in claim 1 as a power plant which charges the above-mentioned rechargeable battery, starting the above-mentioned fuel cell system when the remaining capacity by which the above-mentioned rechargeable battery was detected where a main switch is turned off is below a predetermined value, and charging the above-mentioned rechargeable battery.
[Claim 3] Charging equipment of the electric car which detects the temperature or the OAT of a cel stack object of the above-mentioned fuel cell system, and is characterized by operating this fuel cell system so that the above-mentioned fuel cell system may be started when the cel temperature or the OAT this detected is below freezing temperature, and a temperature rise required for the anti-freeze of the above-mentioned cel stack object may be acquired in claim 2.
[Claim 4] Charging equipment of the electric car characterized by carrying out warming up of the cel stack object with the power generated by the above-mentioned fuel cell system in claim 3 when the condition below the freezing temperature of the above-mentioned cel stack object continues beyond predetermined time after starting of the above-mentioned fuel cell system.
[Claim 5] Charging equipment of the electric car characterized by carrying the engine power plant which consists of a generator driven with the engine for transit, and this engine in claim 1, starting the above-mentioned engine power plant when the remaining capacity by which the above-mentioned rechargeable battery was detected where a main switch is turned off is below a predetermined value, and charging the above-mentioned rechargeable battery.
[Claim 6] Charging equipment of the electric car characterized by preparing the charge turning-on-and-off circuit which turns on and off the current from the above-mentioned power plant to a rechargeable battery, and the discharge turning-on-and-off circuit which turns on and off the current from the above-mentioned rechargeable battery to a drive motor in claim 2 or 5, and carrying out closing motion control of this discharge turning-on-and-off circuit and the charge turning-on-and-off circuit according to operational status.
[Claim 7] Charging equipment of the electric car characterized by asking for the maximum-permissible output of a drive motor based on the maximum output of a power plant, and regulating the demand output of a drive motor below to the above-mentioned maximum-permissible output in claim 6.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the charging equipment of the electric car carrying the rechargeable battery used as the power source of a drive motor while charging with a power plant and this power plant.
[0002]
[Description of the Prior Art] When it is going to constitute electric cars, such as a motor bicycle which carried the engine generator which consists of a generator driven with an engine and an engine as a power plant, the fuel cell, etc., there is constraint from viewpoints, such as storage space, and car weight balance, cost. For this reason, the approach of constituting the source of power from combination of the rechargeable battery (dc-battery) in which the charge for compensating a small fuel cell or an engine power plant, and a power insufficiency is possible is realistic.
[0003]
[The technical problem which invention makes the method of ******] Since a rechargeable battery will be positively used as a source of power from an engine hybrid car etc. when it constitutes the source of power from combination of the above power plants and rechargeable batteries, it is necessary to charge the vacant time amount as much as possible except during transit. However, by the conventional electric car, if it carries out stopping in a parking lot etc. and a main switch is turned off, the vacant time amount with impossible and special charge cannot be used effective in charge.
[0004] This invention is made in view of the above-mentioned conventional trouble, and makes it the technical problem to provide time amount, such as parking, with the charging equipment of the electric car which can charge the capacity insufficiency of a rechargeable battery by constituting the automatic-battery-charge function to a rechargeable battery, also where a main switch is turned OFF.
[0005]
[Means for Solving the Problem] Where a main switch is turned off in the charging equipment of the electric car carrying the rechargeable battery used as the power source of a drive motor, invention of claim 1 detects the remaining capacity of the above-mentioned rechargeable battery periodically, while charging with this power plant during a power plant and transit, and when the this detected remaining capacity is below a predetermined value, it is characterized by starting the above-mentioned power plant and charging the above-mentioned rechargeable battery.
[0006] Invention of claim 2 is characterized by carrying the fuel cell system used as the power source of the above-mentioned drive motor during transit, while functioning in claim 1 as a power plant which charges the above-mentioned rechargeable battery, starting the above-mentioned fuel cell system, when the remaining capacity by which the above-mentioned rechargeable battery was detected where a main switch is turned off is below a predetermined value, and charging the above-mentioned rechargeable battery.
[0007] In claim 2, invention of claim 3 detects the temperature or the OAT of a cel stack object of the above-mentioned fuel cell system, when the cel temperature or the OAT this detected is below freezing temperature, it starts the above-mentioned fuel cell system, and it is characterized by operating this fuel cell system so that a temperature rise required for the anti-freeze of the above-mentioned cel stack object may be acquired.
[0008] In claim 3, after starting of the above-mentioned fuel cell system, invention of claim 4 is characterized by carrying out warming up of the cel stack object with the power generated by the above-mentioned fuel cell system, when the condition below the freezing temperature of the above-mentioned cel stack object continues beyond predetermined time.
[0009] Invention of claim 5 is characterized by carrying the engine power plant which consists of a generator driven with the engine for transit, and this engine in claim 1, starting the above-mentioned engine power plant, when the remaining capacity by which the above-mentioned rechargeable battery was detected where a main switch is turned off

is below a predetermined value, and charging the above-mentioned rechargeable battery.
[0010] In claim 2 or 5, invention of claim 6 prepares the charge turning-on-and-off circuit which turns on and off the current from the above-mentioned power plant to a rechargeable battery, and the discharge turning-on-and-off circuit which turns on and off the current from the above-mentioned rechargeable battery to a drive motor, and is characterized by carrying out closing motion control of this discharge turning-on-and-off circuit and the charge turning-on-and-off circuit according to operational status.
[0011] In claim 6, invention of claim 7 asks for the maximum-permissible output of a drive motor based on the maximum output of a power plant, and is characterized by regulating the demand output of a drive motor below to the above-mentioned maximum-permissible output.
[0012]
[Function and Effect of the Invention] Since according to invention of claim 1 a power plant is started and the rechargeable battery was charged when the rechargeable battery remaining capacity periodically detected where a main switch is turned off was below a predetermined value, a rechargeable battery can be charged using the idle time at the time of un-running, a remaining capacity insufficiency can be compensated, and the power of the sake at the time of the sudden acceleration with much power consumption and climb transit can be conserved.
[0013] Since according to invention of claim 2 the fuel cell system used as the power source of a drive motor was carried as the above-mentioned power plant while charging the above-mentioned rechargeable battery, while being able to run by this system, a power insufficiency can be compensated with a rechargeable battery, and performance-traverse ability can be improved. Moreover, a rechargeable battery can be charged using the idle time at the time of un-running, a capacity insufficiency can be compensated, and the power of the sake at the time of the sudden acceleration with much power consumption and climb transit can be conserved.
[0014] Since according to invention of claim 3 this fuel cell system is started and it was made to carry out the temperature up of this cel stack object to anti-freeze temperature when the temperature or the OAT of a cel stack object of a fuel cell system was below freezing temperature, the life fall of the fuel cell system by freezing of a cel stack object is avoidable.
[0015] Since it was made to carry out warming up of the cel stack object with the power generated by the above-mentioned fuel cell system when the condition below the freezing temperature of the above-mentioned cel stack object continued beyond predetermined time (i.e., when a temperature rise is late), even when an OAT falls to the very low temperature below the freezing point in a cold district etc., freezing of a cel stack object can prevent certainly, and, according to invention of claim 4, the life fall of a fuel cell system can avoid after starting of the above-mentioned fuel cell system.
[0016] Since according to invention of claim 5 the above-mentioned engine power plant is started and the above-mentioned rechargeable battery was charged when the remaining capacity by which the rechargeable battery was detected where a main switch is turned off was below a predetermined value, a rechargeable battery can be charged using idle time, the lack of remaining capacity can be compensated, and the power of the sake at the time of the sudden acceleration with much power consumption and climb transit can be conserved.
[0017] Since according to invention of claim 6 the charge turning-on-and-off circuit which turns on and off the current from the above-mentioned power plant to a rechargeable battery, and the discharge turning-on-and-off circuit which turns on and off the current from the above-mentioned rechargeable battery to a drive motor are prepared and it was made to carry out closing motion control of this both turning-on-and-off circuit according to operational status, charge and the discharge current are certainly controllable.
[0018] For example, when rechargeable battery remaining capacity is in an important point charge condition and rechargeable battery temperature is during transit in [predetermined / which can be charged] a temperature requirement, by closing a charge turning-on-and-off circuit, and opening a discharge turning-on-and-off circuit, the generation-of-electrical-energy current according [without consuming the discharge current] to a regeneration current or a power plant can be used as the charging current, and is efficient.
[0019] Since according to invention of claim 7 it asks for the maximum-permissible output of a drive motor based on the maximum output of a power plant and the demand output of a drive motor was regulated below to the above-mentioned maximum-permissible output, also in the state of a full throttle, a drive motor can prevent not requiring the output beyond the maximum-permissible output of a power plant, and covering a superfluous load over a power plant, and can prevent the life fall of the whole system, and the power down by the overload.
[0020]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained based on an accompanying drawing. Drawing 1 - drawing 8 are drawings for explaining 1 operation gestalt of this invention, and, for

the side elevation carrying the fuel cell drive system by which drawing 1 contains the charging equipment of this operation gestalt of a motor bicycle, and drawing 2 , a fuel cell drive structure-of-a-system Fig. and drawing 3 are [the explanatory view of charge/discharge keying circuit of operation and drawing 8 of the functional block diagram of the controller of a fuel cell system, drawing 4 - drawing 7] the flow charts for explanation of operation.

[0021] In drawing 2 , the above-mentioned fuel cell drive system consists of a fuel cell system (FC) 1 and a driving gear 2, and this fuel cell drive system charges a dc-battery (rechargeable battery) 28 with the above-mentioned power while making it run a motor bicycle 20 by supplying the power generated by the fuel cell system 1 to the drive motor 3 of the above-mentioned driving gear 2. And when the generation-of-electrical-energy capacity of the above-mentioned fuel cell equipment 1 is insufficient to the demand output by throttle actuation of an operator, this insufficiency is compensated by the power from a dc-battery 28.

[0022] The above-mentioned fuel cell system 1 carries out circulation supply of the water into the above-mentioned cel stack object 7 by the water supply system 8, and generates the electrical and electric equipment by supplying the air further for cooling in the above-mentioned cel stack object 7 by the air supply system 9 while it supplies hydrogen to the cel stack object 7 by the hydrogen supply system 6. Moreover, 4 is a FC controller which performs various control of this fuel cell system 1 and which is mentioned later.

[0023] The above-mentioned water supply system 8 supplies the water in a water tank 43 to the above-mentioned cel stack object 7 with the water pump 44 for cooling humidification, and it is constituted so that the water which passed through this may be returned in a water tank 43 through the heat exchanger 45 of moisture time condemnation.

[0024] The above-mentioned air supply system 9 carries out suction installation of the open air around a dc-battery 28 with the cooling fan 31 arranged in the below-mentioned ventilation-flue 25b, and supplies the this introduced air in the above-mentioned cel stack object 7. Moreover, air is made to shunt from above-mentioned ventilation flue 25b by Blois 46, and this is supplied in the above-mentioned cel stack object 7 as a dried air by which separation removal of the moisture was carried out by the heat exchanger 45 of moisture time condemnation. In addition, the moisture by which separation was carried out [above-mentioned] is collected in the above-mentioned water tank 43.

[0025] The above-mentioned hydrogen supply system 6 is equipped with the methanol tank 50, the reformer (reformer) 51 equipped with heater 51a, evaporator 51b, and catalyst bed 51c, and CO reduction equipment 52. The above-mentioned reformer 51 heats evaporator 51b with the fuel of the methanol supplied from the methanol tank 50 by heater 51a, and the air supplied from burner fan 51d, makes the composite fuel of the methanol and water which were supplied to this evaporator 51b evaporate, and manufactures hydrogen gas.

[0026] It is inside in the middle of the piping path which is open for free passage to the above-mentioned CO reduction equipment 52, and the air from air pump 52for reaction a is mixed, and it is cooled by the air from fan 52for cooling b, and the hydrogen gas by which manufacture was carried out [above-mentioned] is supplied to the above-mentioned cel stack object 7 after that.

[0027] The above-mentioned driving gear 2 is constituted so that a dc-battery (rechargeable battery) 28 may be charged with the above-mentioned power, while supplying the power supplied from the above-mentioned fuel cell system 1 to a motor 3 through DC/DC converter (power controller) 2b by Maine controller 2a for cars according to the input command from the throttle grip of the above-mentioned motor bicycle 20 and making it run this motor bicycle 20. When the output of the above-mentioned fuel cell system 1 is insufficient to a demand, it is compensated by the power of the above-mentioned dc-battery 28.

[0028] As shown in the left-hand side part of drawing 3 , the above-mentioned DC/DC transducer 2b intervenes between the above-mentioned fuel cell system 1 and the dc-battery 28, and this DC/DC transducer 2b has the function which the electrical potential difference/current which the fuel cell system 1 outputs are changed, and is changed into new electrical potential difference/current. Moreover, this DC/DC converter 2b detects the reference signal electrical potential difference inputted from a controller 4, and has the function to adjust DC/DC output voltage free so that it may mention later.

[0029] The above-mentioned FC controller 4 has the function shown in drawing 3 . Namely, the system power control section 11 to which this controller 4 mainly carries out package management of the power source of the various equipments for operating the above-mentioned fuel cell system 1 and a driving gear 2 (system power control function), The charging current control section 12 which controls the charge condition of a dc-battery 28 (charging current control function), The warming-up operation-control section 13 for preventing freezing of the cel stack object 7 (warming-up operation-control function), An electrical potential difference, the electrical potential difference of the fuel cell system 1 inputted through the current detecting elements 53a and 53b, and FC output operation part 53 that sets up the maximum-permissible output to a motor based on a current, It has the rechargeable battery protection control section 14 which sets up the maximum-permissible output to a motor based on power resource and temperature, and opens and closes

open/close switches 32a and 33a (relay).
[0030] By the above-mentioned controller 4, also after a main switch 5 is turned off, the power for functional maintenance is continuously supplied from a dc-battery 28. The on-off logic of a main switch 5 is detected by the main-switch detecting element 16 through interface 15a. At the time of off detection moreover, by the function as a system power control section 11 The controller power source 17 is controlled by the low-power condition, and the power source of motor controller 2a and DC/DC converter 2b is turned off through Interfaces 15b and 15c. In addition, it becomes the main functions that a timer signal is outputted from the timer time amount detecting element 18 for every fixed time amount, and the on-off detecting signal of a main switch 5 is outputted in the state of [above-mentioned] a low power.
[0031] After [off] the above-mentioned main switch 5, if fixed time amount passes, a controller 4 will reboot. Moreover, by the function as the above-mentioned charging current control section 12 It is detected by real time by the sensor which is not illustrated with the addition remaining capacity calculated from current addition. Rechargeable battery remaining capacity is judged from the battery voltage and temperature which were inputted through electrical-potential-difference detecting-element 12c and 12d of temperature detecting elements. If this rechargeable battery remaining capacity is not a full charge, an activate request signal will be outputted to FC starting decision section 12a, and a starting on-off signal will be outputted to the fuel cell system 1 through interface 15d. Moreover, an electrical-potential-difference command value is outputted to DA converter 12b, and a reference voltage signal is supplied to DC / DC converter 2b through interface 15c. In addition, the charging current from DC/DC converter 2b is always detected by the current sensor 19, and it is inputted into this charging current control section 12 through current detecting-element 12e, and the output voltage of DC/DC converter 2b is controlled so that a dc-battery 28 is charged by the optimal charging current.
[0032] In the fuel cell system 1, although the noise is not generated from the generation-of-electrical-energy operation itself, motor sounds, such as an air pump for a reaction, a cooling pump, and a cooling fan, etc. occur here. Although these sounds are not worried during transit, it may sense under parking and in the dead of night as the noise which the fuel cell system 1 starts automatically by the automatic-battery-charge function.
[0033] So, with this operation gestalt, user switch 12f is prepared in the user control panel so that a user can set up effective/invalid of the automatic-battery-charge function of the fuel cell system 1 according to a situation. Decision of the existence of an automatic-battery-charge function is enabled by detecting turning on and off of this user switch 12f.
[0034] By the function as the above-mentioned warming-up operation-control section 13, at the time of the reboot for every fixed time amount by the timer The OAT detected by OAT sensor 13a reads through interface 15e and temperature detecting-element 13b. Rareness, Moreover, the temperature of the cel stack object 7 of the fuel cell system 1 is read through interface 15c and temperature detecting-element 13c. It is concerned with dc-battery remaining capacity, an activate request signal and an electrical-potential-difference command value signal are outputted to the ** case by which temperature below the freezing point was detected as an OAT or cel temperature that there is nothing, the fuel cell system 1 starts, and the warm-up of the fuel cell system 1 is performed.
[0035] In this warm-up, the output from DC/DC converter 2b is first forbidden by adjustment of the reference voltage signal of DC/DC converter 2b. Then, thereby, while the fuel cell system 1 generates only power required for own operation and making fuel consumption into the minimum, the cel stack object 7 is warmed slowly and, as a result, freezing is prevented.
[0036] And the warm-up of the above-mentioned fuel cell system 1 is continued until it becomes the temperature field which whenever [cel stack temperature / by which detection was carried out / above-mentioned] does not freeze. In this warm-up, when a temperature rise is late, a reference signal electrical potential difference is adjusted to a large value, prohibition of the output from DC / DC converter 2b is canceled, and the amount of generations of electrical energy by the fuel cell system 1 increases. In this case, the excessive power outputted from DC/DC converter 2b is consumed at the heater 34 formed near the FC cooling fan 31, the warm air warmed by this heater generation of heat is supplied to the cel stack object 7 by the cooling fan 31, and, as a result, warming up of this cel stack object 7 is promoted. In addition, the approach of warming circulating water of the cel stack object 7 with the power of the above-mentioned excess may be adopted. In this case, it will be warmed from the interior of a cel with circulating water.
[0037] After the full charge of the dc-battery 28 is carried out as mentioned above and the temperature rise for freezing evasion is checked, an off signal is outputted from a controller 4 to the fuel cell system 1, and self shifts to a low-power condition again after that.
[0038] In addition, the fuel cell system 1 surely generates heat with a generation of electrical energy. In this case, overheating of the cel stack object 7 has serious effect on the engine performance and life of the fuel cell itself. For this reason, water-cooled structure is adopted as a cel stack object, and if it is air cooling, it has the cooling fan etc. the warm-up of the above-mentioned freezing evasion -- if it is, in order to raise temperature early except for the case where

the warm air by above-mentioned heater generation of heat is supplied, as for the above-mentioned cooling fan, considering as the configuration which is not rotated is desirable.
[0039] In cel temperature, even if too low and too high, the engine performance falls, and the fuel cell system 1 has the temperature zone of optimum efficiency further again. Therefore, it is desirable although considered as the configuration which does not turn a cooling fan for the time being in order that a generation of electrical energy at a room temperature may also promote warming up of a cel stack object after starting.
[0040] The above-mentioned rechargeable battery protection control section 14 functions as follows. Based on the battery voltage read through above-mentioned electrical-potential-difference detecting-element 12c, 12d of temperature detecting elements, and current detecting-element 12e, temperature and the charging current, and the discharge current, power resource are calculated in capacity calculation section 14a, and the maximum-permissible output (load limitation value) to a drive motor 3 is calculated by the above-mentioned rechargeable battery protection control section 14 based on these power resource and the above-mentioned dc-battery temperature.
[0041] And while the maximum-permissible output for which motor output count section 2c was asked by the above-mentioned rechargeable battery protection control section 14 and the above-mentioned FC output operation part 53 is inputted, the throttle opening detected by throttle sensor 2d is inputted through interface 15f, it is smallness, and the motor output according to the above-mentioned throttle opening calculates, and, thereby, this motor-control signal is outputted from the above-mentioned maximum-permissible output to motor controller 2a through interface 15g.
[0042] The control signal created on the other hand based on power resource, dc-battery temperature, etc. which were calculated by the above-mentioned capacity calculation section 14a is outputted to the charge turning-on-and-off circuit 32 and the discharge turning-on-and-off circuit 33. This charge turning-on-and-off circuit 32 consists of open/close switch (relay) 32a and diode 32b which permits only the current by the side of a dc-battery, and the discharge turning-on-and-off circuit 33 consists of open/close switch (relay) 33a and diode 33b which permits only the current from a dc-battery. In addition, the above-mentioned charge and the discharge turning-on-and-off circuits 32 and 33 may be established in - pole side of a dc-battery 28.
[0043] The above-mentioned open/close switches 32a and 33a are opened and closed here on the conditions shown in drawing 4 - drawing 7 . That is, drawing 4 is the case where both charge and discharge are forbidden, and both charge open/close switch 32a and discharge open/close switch 33a have open. Moreover, drawing 5 permits charge, discharge is the case where it forbids, charge open/close switch 32a is close, and discharge open/close switch 33a has open. Furthermore, drawing 6 forbids charge, discharge is the case where a permission is granted, charge open/close switch 32a is open, and discharge open/close switch 33a has close. Drawing 7 is the case where both charge and discharge are permitted, and both discharge open/close switch 32a and charge open/close switch 33a have close further again.
[0044] It is adopted that it is a full charge when dc-battery temperature is higher than a upper limit or lower than a lower limit as charge prohibition conditions here, or ** is adopted, and there is dc-battery temperature within limits which can be charged as charge authorization conditions, and there are power resource within limits [predetermined] which can be charged.
[0045] Moreover, it is adopted that below predetermined discharge prohibition capacity value and dc-battery temperature have power resource higher than a upper limit, they are lower than a lower limit as discharge prohibition conditions, or ** is adopted, and dc-battery remaining capacity is more than predetermined discharge possible capacity as discharge authorization conditions, and there is dc-battery temperature within limits [predetermined] which can be discharged.
[0046] And the above-mentioned fuel cell system 1 and the driving gear 2 are carried in the motor bicycle 20 shown in drawing 1 , and this motor bicycle 20 has the following outline structures. The car-body frame 21 is the thing of a type which connected the side pipes 21c and 21c of the left and a right pair to the lower limit of Maine pipe 21b prolonged in a back slanting lower part from head-tube 21a of the front end, extended these side pipes 21c and 21c back at an abbreviation horizontal, formed 21d of low-floor footrest areas, and extended this to the back slanting upper part further.

[0047] A front fork 22 is supported pivotably by the above-mentioned beef fat pipe 21a free [right-and-left steering], a front wheel 23 is supported to revolve with the lower limit of this front fork 22, and the steering handle 24 is being fixed to upper limit. Moreover, the sheet 30 is carried above the above-mentioned side pipe 21c, and the perimeter of the above-mentioned front fork 22 and the right-and-left flank of the car-body frame 21 are surrounded with the car-body covering 25 made of resin.
[0048] Moreover, the front end section of the motor unit 26 of a unit swing type is supported pivotably by the back slanting upper part extension of the above-mentioned side pipe 21c, and the rear wheel 27 is supported to revolve with the back end section of this motor unit 26. This motor unit 26 combines in one the motor 3 which turned the axis to the

cross direction and has been arranged, and the transmission case 29 back prolonged in the car left-hand side section.
[0049] Moreover, the casing 10 by which the dc-battery 28 grade of the cel stack object 7 of the above-mentioned fuel cell system 1 and the above-mentioned driving gear 2 was held on support frame 21e constructed in 21d of footrest areas of right and left of the above-mentioned car-body frame 21 and 21d and 21e is carried. Moreover, the above-mentioned water tank 43 is carried in this casing 10 bottom, and the above-mentioned methanol tank 50 is carried in the car-body posterior part. In addition, 50a is a closing motion valve and 50b is a pressure regulating valve.
[0050] And in the above-mentioned car-body covering 25, cowling duct 25b which introduces a transit wind towards the above-mentioned casing 10 is formed, and opening of the wind hole 25a of this cowling duct 25b is carried out towards the car front. Moreover, the above-mentioned cooling fan 31 is arranged at the above-mentioned casing 10 inlet-port section of the above-mentioned cowling duct 25b. Moreover, the cooling wind which came out of casing 10 is discharged outside from 25d of derivation openings through derivation way 25c by which the above-mentioned methanol tank 50 has been arranged.
[0051] Actuation of this operation gestalt is explained in full detail based on the flow chart of drawing 8 . If OFF of a main switch 5 is detected and automatic battery charge and an anti-freeze program start, a controller 4 will shift to a small power condition (low-power condition), if it stands by in the state of small power until a timer signal when an external signal 5, for example, a main switch, carries out ON detecting-signal ****** predetermined time progress is inputted, and an external signal is inputted, a small power condition will be canceled and the class of external signal will be judged (step S1 - S4).
[0052] When [both] an external signal is a main-switch-on detecting signal, while charge on-off switch (relay for charge) 32a and discharge on-off switch (relay for discharge) 33a are made close, a fuel cell system start switch is turned on (steps S5 and S6). moreover, 12f of user configuration switches, battery voltage, dc-battery temperature, and throttle opening input -- having (step S7 - S9) -- Dc-battery remaining capacity calculates (step S10), and when dc-battery remaining capacity is a dc-battery piece below a predetermined value, relay 33a for discharge is turned off (step S12). Moreover, when it is not a dc-battery piece or a full charge, either, relay 32for discharge a and relay 33a for charge are held for both at ON (step S13). A motor load limitation value (maximum-permissible output value) is calculated, and a motor output value is determined from this limiting value and throttle opening (step S 14 15). In addition, when it is judged that a dc-battery is a full charge in the above-mentioned step S11, relay 32a for charge is turned off (step S16), and a motor output value is determined immediately, without setting up a motor load limitation value. And when ON of a main switch 5 is continuing, it returns to step S6, and return and when it is turned off, it returns to step S1.
[0053] In the above-mentioned step S4, when an external signal is a timer signal, the temperature of the cel stack object 7, battery voltage, and dc-battery temperature are inputted, and dc-battery remaining capacity is calculated (steps S18-S20). And by the case where whenever [cel stack temperature] is beyond a predetermined value, when power resource run short, 12f of user configuration switches is checked (steps S21-S23).
[0054] When 12f of user configuration switches is prohibition of automatic battery charge, the amount of self-discharge is calculated, dc-battery remaining capacity is calculated (steps S24 and S25), and it returns to step S1 after that. Moreover, when 12f of user configuration switches is automatic-battery-charge implementation, it shifts to an automatic-battery-charge step. In addition, when power resource are insufficient, it shifts to step S24 regardless of a user configuration switch.
[0055] When whenever [cel stack temperature] is below a predetermined value in the above-mentioned step S21, and when the user configuration switch serves as automatic-battery-charge implementation at step S23, a fuel cell system start switch is turned on (step S26), whenever [cel stack temperature] is inputted into a dc-battery current, battery voltage, dc-battery temperature, and a pan (steps S27 and S28), and whenever [power-resource and cel stack temperature] is judged (step S29).
[0056] When power resource are insufficient, count of power resource and count of a need charging current value are performed (steps S30 and S31), a fuel cell system-demand output is calculated continuously, D/A conversion of this calculated value is carried out, and an electrical-potential-difference value is outputted to DC/DC converter 2b (steps S32-S34).
[0057] A heater 34 is turned off, when whenever [cel stack temperature] is judged to be below a predetermined value at step S29, and when a heater 34 is turned on when the condition below this predetermined temperature is continuing beyond predetermined time, and not continuing beyond predetermined time (steps S35-S37). In addition, power resource are not insufficient, and when whenever [cel stack temperature] is not below predetermined temperature, processing shifts to step S1.
[0058] Thus, according to this operation gestalt, where a main switch 5 is turned off, the remaining capacity of a dc-

battery 28 is detected periodically. Since the fuel cell system 1 is started and the dc-battery 28 was charged when the detected this dc-battery remaining capacity was below a predetermined value The distance which can be run is extensible, while fully being able to charge a dc-battery 28 using the idle time at the time of un-running, such as night, being able to compensate an insufficiency and being able to compensate the lack of an output of the fuel cell system 1 at the time of transit.

[0059] Moreover, with this operation gestalt, since this fuel cell system 1 is started and it was made to carry out the temperature up of the cel stack object 7 to anti-freeze temperature when the temperature or the OAT of the cel stack object 7 of the fuel cell system 1 was below freezing temperature, the life fall of the fuel cell system 1 by freezing of the cel stack object 7 is avoidable.

[0060] furthermore, when the condition below the freezing temperature of the above-mentioned cel stack object 7 continues beyond predetermined time after starting of the above-mentioned fuel cell system 1 (i.e., when a rate of temperature rise is slow) Since a heater 34 is made to generate heat with the power generated by the above-mentioned fuel cell system 1, the warm air by this is supplied to the cel stack object 7 with a cooling fan 31 and it was made to carry out warming up of this Even when an OAT falls to the very low temperature below the freezing point in a cold district etc., freezing of the cel stack object 7 can be prevented certainly, and the life fall of the fuel cell system 1 can be avoided.

[0061] Since the discharge turning-on-and-off circuit 33 which turns on and off the discharge current from the charge turning-on-and-off circuit 32 which turns on and off the charging current from the above-mentioned fuel cell system 1 to a dc-battery 28, and a dc-battery 28 to a drive motor further again is formed and the charging current and the discharge current were controlled according to the operation situation, charge and the discharge current can be certainly controlled, as it is the following.

[0062] For example, ** dc-battery temperature is higher than a upper limit, or when lower than a lower limit, as shown in drawing 4 , by making open both the charge turning-on-and-off circuit 32 and the discharge turning-on-and-off circuit 33, both charge and discharge are forbidden and the life fall of a dc-battery 28 can be avoided.

[0063] ** Dc-battery remaining capacity is below discharge prohibition capacity value, and a regeneration current can be used as the charging current, without consuming the discharge current by closing the charge turning-on-and-off circuit 32, and opening the discharge turning-on-and-off circuit 33, as shown in drawing 5 when there is dc-battery temperature within limits [predetermined] which can be charged, and it is efficient.

[0064] ** When a dc-battery is in a full charge condition and dc-battery temperature is in the predetermined range which can be discharged, the generation-of-electrical-energy force of the fuel cell system 1 and the auxiliary power by the dc-battery 28 can be demonstrated to the maximum extent, and max can be made to demonstrate the motorised force by use by opening the charge turning-on-and-off circuit 32, and closing the discharge turning-on-and-off circuit 33, as shown in drawing 6 .

[0065] ** Dc-battery remaining capacity is beyond a predetermined value, when there is dc-battery temperature within limits [predetermined] which can be discharged [charge/], it can use effectively as motorised auxiliary power, charging a dc-battery 28 by making open both the charge turning-on-and-off circuit 32 and the discharge turning-on-and-off circuit 33, as shown in drawing 7 , and the distance which can be run can be extended.

[0066] Since it asks for the maximum-permissible output of a drive motor based on the maximum output of the fuel cell system 1 and the demand output of a drive motor was regulated below to this maximum-permissible output further again, also in the state of a full throttle, a drive motor can prevent not requiring the output beyond the above-mentioned maximum-permissible output, and covering a superfluous load over the fuel cell system 1, and can prevent the life fall of the whole system.

[0067] In addition, although DC / DC converter 2b was used for output adjustment of the fuel cell system 1 with the above-mentioned operation gestalt, this DC/DC converter is not indispensable in this invention. For example, it is also possible to order it from a controller required current value / electrical-potential-difference value by technique, such as serial communication, and to take out required current/electrical potential difference to the fuel cell system 1.

[0068] Moreover, it is also possible to use a switching element like FET instead of the above-mentioned DC/DC transducer, and to control the output of a fuel cell system.

[0069] The above-mentioned operation gestalt explains the case where a power plant is the fuel cell system 1 further again, and as a power plant in this invention merely The engine power plant which consists of a gasoline engine, a diesel power plant, a gas engine, etc. and a generator driven by these is also employable. When the dc-battery remaining capacity detected where a main switch 5 is turned off is below a predetermined value, this engine power plant is started and you may make it charge a dc-battery. Even when it does in this way, a dc-battery can be charged using idle time, the lack of dc-battery remaining capacity can be compensated, and the distance which can be run can be extended.

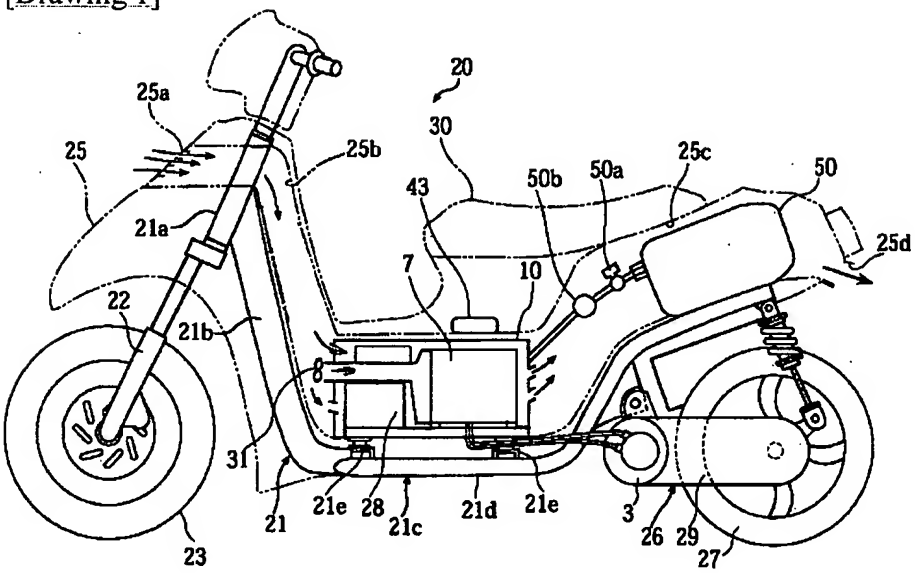
[Translation done.]

* NOTICES *

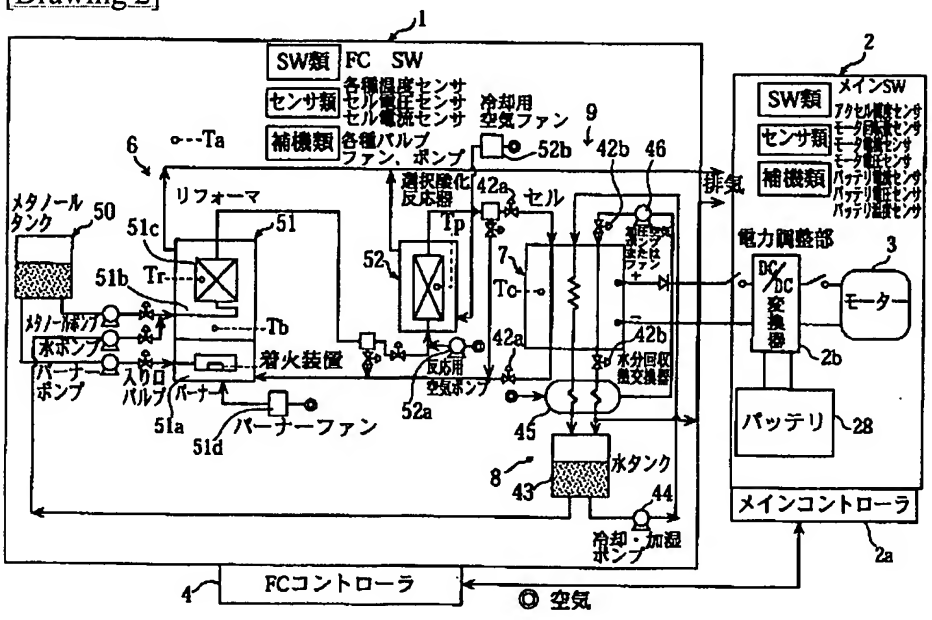
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

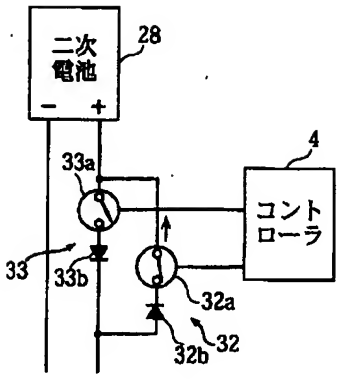
[Drawing 1]



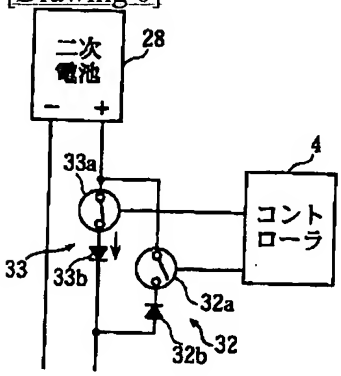
[Drawing 2]



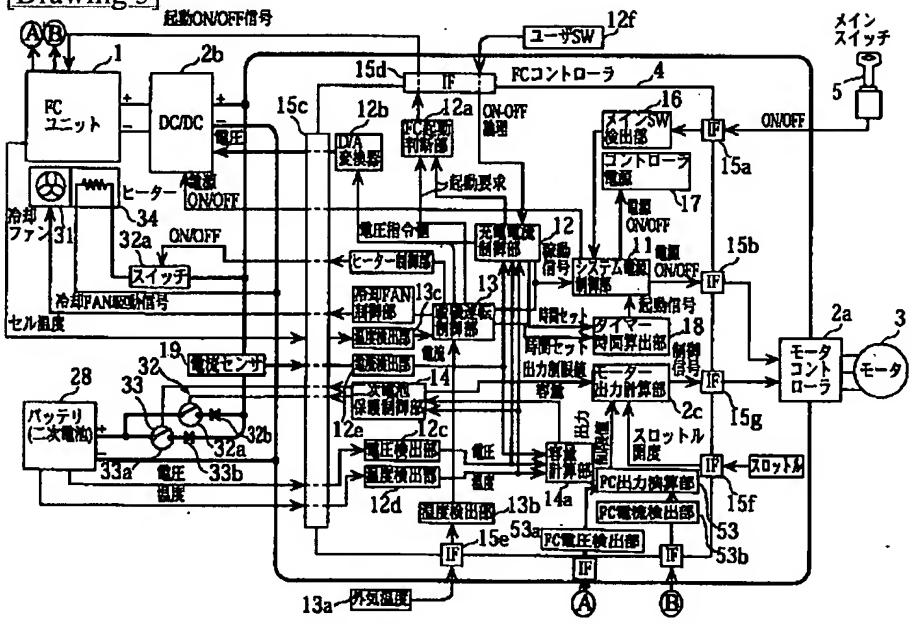
[Drawing 5]



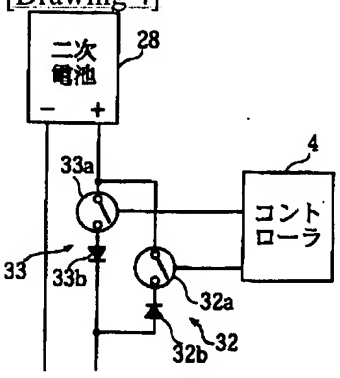
[Drawing 6]



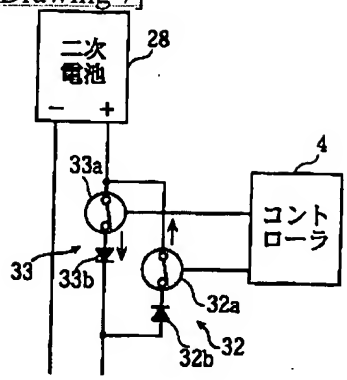
[Drawing 3]



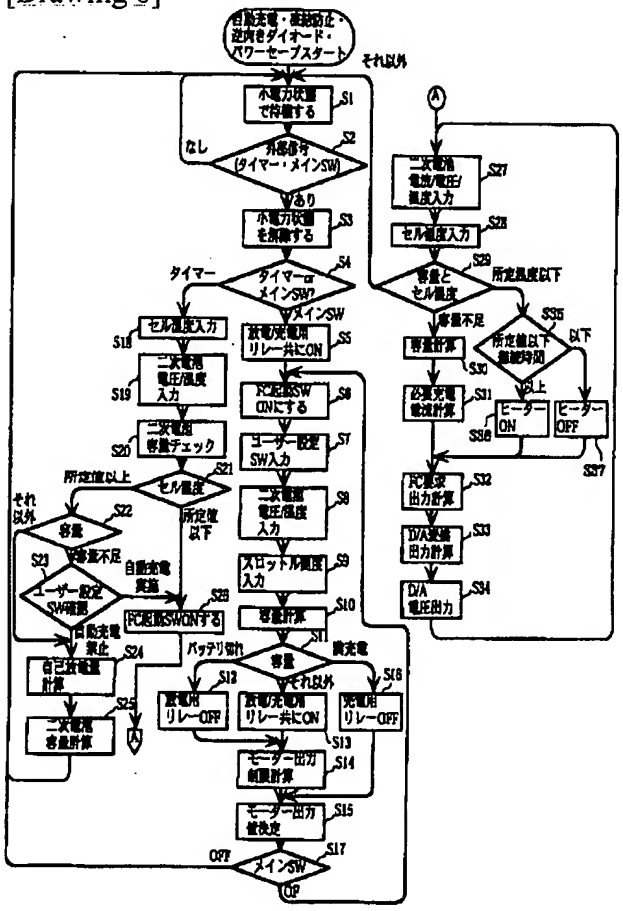
[Drawing 4]



[Drawing 7]



[Drawing 8]



[Translation done.]